AQUARIUS/SAC-D

Aquarius Ground System Integration, Test and Training Plan

Aquarius Project Document: **AQ-336-0244**
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Initial v1.2

Aquarius Ground System Integration, Test and Training Plan

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-	18 May 2011	All	Initial Release	AQ Mission Systems Engineer added as an approver.
1	20 Jul 2011	43-58	Initial v1.1	Updated V&V matrix
2	8 Sept 2011	ii	Initial v1.2	Changed CONAE signatory from C. Filici to M. Oglietti.

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1. Introduction

1.1 Purpose

The purpose of this document is to verify the Aquarius Ground System Level 3 and Level 4 Requirements; to describe the plan for integrating and testing selected Aquarius Ground System segments; to describe the plan for the overall integration and testing of the Aquarius Ground System with the Satelite de Aplicaciones Cientificas D (SAC-D) Ground System (SAC-D GS); and to describe the training plan for Aquarius Ground System operators.

1.2 Scope

This plan provides the information necessary to design, execute, and report on the testing of selected Aquarius Ground System (AQ GS) segments, their integration into the system level configuration of the AQ GS, the system level testing of the AQ GS, and the system level integration and testing of the AQ GS with the SAC-D GS. These segments are: the Aquarius Validation Data Segment (ADPS), the Physical Oceanography Distributed Active Archive Center (PO.DAAC), and the Aquarius Command and Control System (ACCS).

Not covered in this document are the AVDS integration and testing and the interface testing between Comision Nacional de Actividades Espaciales (CONAE) and the NASA Ground Network (NGN). The AVDS integration and test are covered in the Aquarius Validation Data Segment Development Plan. The CONAE-NGN interface tests are the responsibility of CONAE and are covered in the SAC-D document SAC-D Ground System Integration and Test Plan, GS-GSD-AIV-PL-00100-A.

1.3 AQ GS System Integration and Test Approach

The AQ GS test approach is to ensure that AQ GS test objectives are met in a twofold fashion. The first is to plan and execute standard component and system level tests that verify Level 3 and 4 requirements. The second is to simulate full operations on a daily basis for at least one year prior to launch. This extensive testing will support validation, stressing the system, rehearsing anomaly detection and response, and iterative optimization of science data processing algorithms.

1.3.1 AQ GS Subsystem Test Approach

AQ GS subsystem test engineers will perform subsystem-level testing and provide associated documentation such as test reports. In addition, subsystem test engineers will participate in the Integration and Test process on an as-needed basis.

The test report for each subsystem will include the normal pass or fail notation for each deliverable capability. It will also include any liens against delivery expectations, and, if necessary, workarounds developed during the subsystem testing to allow for a deliverable, and testable, product.

2. Documentation

The scope of AQ GS I&T is defined by the verification items that will be derived from the following documents:

AQ GS L3 and ACCS Level 4 requirements: These are requirements that address capabilities, processes, and performance of tools.

AQ/SAC-D Ground System ICD: Formats and processes for exchange of command plans, science, ancillary and auxiliary data, and notifications, requests and reports between the SAC-D and AQ Ground Systems.

AQ GS – PO.DAAC ICD: Formats and processes for transfer of selected Aquarius data products from the Aquarius Ground System to the JPL PO.DAAC.

2.1 Applicable Documents

2.1.1 Controlling Documents

The following documents control the content of this document.

Document Number	Document Title
AQ-213-0098	Aquarius Project-Level Verification and Validation Plan

Table 1-1. Controlling Documents

2.1.2 Reference Documents

The following documents are referenced in this document or provide guidelines for general verification and validation practices that have been incorporated into this document. Execution of this plan does not require personnel to consult these documents for compliance.

Document Number	Document Title
AQ-212-0037	Aquarius Science Calibration/Validation Plan
AQ-316-0239	Aquarius Command and Control System Software Management Plan
AQ-222-0039	Level 2A Science Requirements
AS-223-0101	Level 2B AS Mission System Requirements
AQ- 326-0152	Level 3 Aquarius Ground System Requirements
AQ-426-0197	Level 4 Aquarius Command and Control Segment Requirements
AQ-385-0116B	Aquarius Command Dictionary
AQ-385-0262A	Aquarius High Rate Data Structure Definition
AQ-385-0115A	Aquarius Telemetry Dictionary
AQ-385-0111	Aquarius Flight Rules, Constraints and Idiosyncrasies
AS-336-0151c	Aquarius-SAC-D Ground System Interface Control Document
JPL D-45512	End-to-End Information System (EEIS)
JPL D-45075	Operations Readiness Testing
AS-	AQ SAC-D Mission System Test Plan
JPL Design File 79	AQ Incompressible Test List
JPL Design File 80	AQ “Test As You Fly” Exceptions Listing

Table 1-2. Reference Documents

3. Aquarius Ground System Description

The Aquarius Ground System is the integrated set of ground software, hardware, facilities and networks that support Aquarius Science Data Processing and Mission Operations. The Aquarius Ground System (AQ GS) consists of four primary elements: The Aquarius Data Processing System (ADPS), the Aquarius Command and Control System (ACCS), the Aquarius Validation Data System (AVDS) and the Physical Oceanography Distributed Active Archive Center (PO.DAAC) located at the Jet Propulsion Laboratory (JPL) in Pasadena, CA. The diagram in Figure 1.1 depicts the elements and interfaces of the Aquarius Ground System.

The ADPS captures, archives, processes and distributes Aquarius science data. The ACCS generates and schedules instrument commands that are forwarded to CONAE and merged with the AQ/SAC-D pass plans. The ACCS also captures, displays, and supports analysis of Aquarius science and telemetry data for health monitoring purposes. Both the ADPS and the ACCS are located at Goddard Space Flight Center (GSFC) in Greenbelt, MD.

The AVDS fetches sea surface salinity data from non-Aquarius sources such as ocean buoys and temporally and geographically matches sample sets to Aquarius data in order to validate the Aquarius data. The matching process of the AVDS is performed at Goddard Space

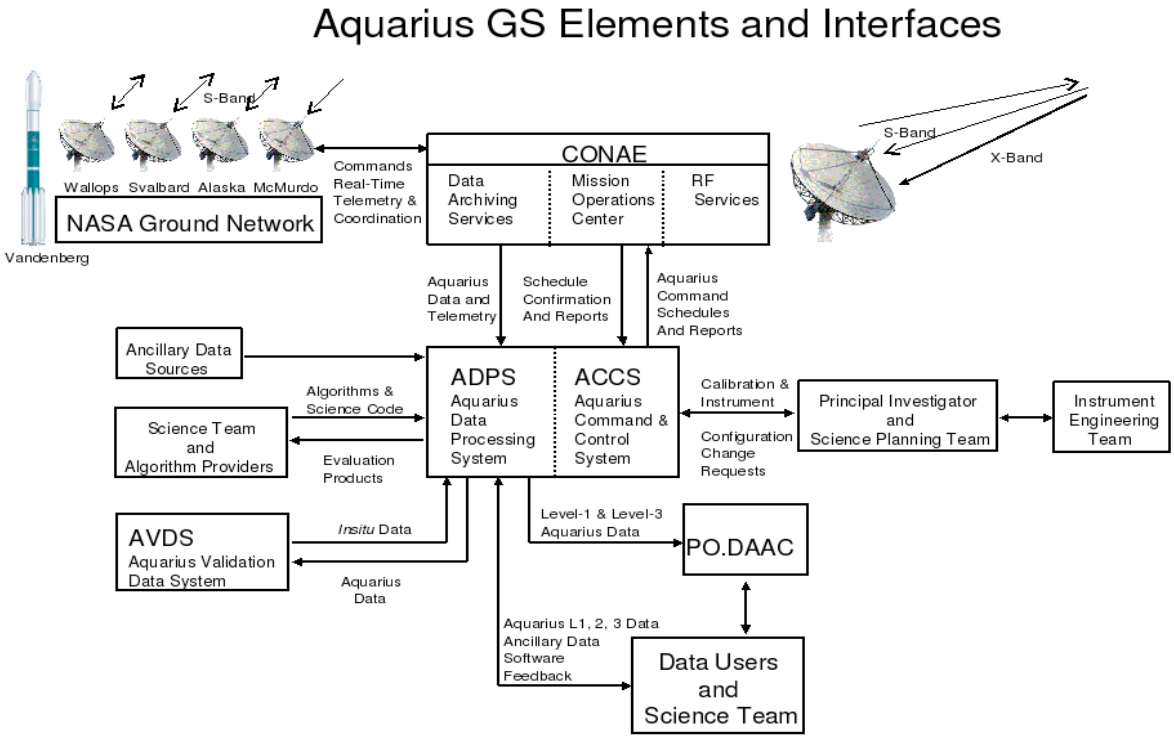

Figure 1.1 Aquarius Ground System Elements and Interfaces

Flight Center (GSFC) and the collection and analysis elements of the system reside at the Principal Investigator's offices at Earth and Space Research in Seattle, WA.

The JPL PO.DAAC serves as the primary repository of Aquarius Level 1A and Level 3 (final product) data. All Aquarius Level 1A and Level 3 data are provided to the PO.DAAC by the GSFC ADPS.

4. AQ GS Integration & Test Process

Integration Planning includes the following steps:

- Identify the components or system elements to be integrated
- Generate the integration document that describes each electrical and mechanical interface
- Perform the electrical and mechanical interfaces as described
- Test each interface

Test Planning includes the following steps:

- Designing test cases for a GS element build
- Allocate Level-4 requirements to test cases.
- Repeat till all Level-4 requirements are accounted for
- Update requirement to test case mapping
- Identify test configuration
- Identify simulator upgrade requirements

Developing a Test Procedure includes:

- Step by step test procedure development
- Define test configuration
- Develop input data (if required)
- Develop expected results (if required)
- Define success criteria
- Develop operations language scripts (if required)

Aquarius Test Development Working Group (ATDWG) review:

- Review test case plan, test configuration, verification cross reference matrix and step by step test procedure
- Incorporate ATDWG comments

Participate in CONAE tests:

- Obtain Test plan and cases to be used at CONAE
- Coordinate with GS engineers to witness tests
- Witness test execution at CONAE

Ship/Install:

- Coordinate with GS engineers to schedule installation at GSFC
- Perform installation and checkout

Component tests planning and execution:

- Schedule test and resources
- Coordinate to update simulators
- Execute component tests
- Report Test status

- Coordinate with GS engineers to resolve problems

Integration tests planning and execution:

- Schedule test and development resources
- Execute Integration tests
- Coordinate with GS engineers to resolve problems
- Report Test status

GS System test planning and execution:

- Schedule external agency resources/systems
- Coordinate with external agencies
- Execute Aquarius GS system tests
- Coordinate with GS engineers to resolve problems
- Report Test status

4.1 Test Methodology

AQ Ground System tests will utilize the following test process.

- Identify test cases
- Define test cases
- Develop detailed test procedures
- Present test cases and procedures to ATDWG Test Review Board
- Execute tests and file results
- Provide completed test folders to Quality Assurance (QA) for review and archiving

Separate test folders will be maintained for each test case. The test folders will include a copy of the test procedure with hardcopy reports and/or screen snapshots that document the test and indicate whether or not the evaluation criteria were met or problem reports were written during the execution of the test.

The test procedure will include step-by-step instructions. The test folder, when submitted to QA, will contain an as-run test procedure, including all red-lines, as well as a corrected copy that has the red-lines incorporated in the test procedure.

Identify Test Cases

This step consists of following activities:

- Identify any new test cases or modification to existing test cases to verify and test assigned problem reports and requirements.
- Identify the set of regression tests.
- Estimate required string test time based on the following:
  - Number of Debug runs, Dry-runs, Run-for-records, Regression runs
  - Number of times a test will be repeated
  - Test string(s) needed to run the test

Define Test Cases:

The test case descriptions provide a concise way of documenting the major aspects of the test. They also provide a centralized repository to identify all related test products (test procedures, scenarios, etc.) to ensure that requirements are tested

Develop Detailed Test Procedure:

This step creates the required test data. It includes the following activities:

- Create test input:
  - Simulator scripts and scenario files
  - Command language procedures
  - FSW loads
  - Real-time display pages
  - Utilities
- Obtain products used to verify the test output
  - FSW dumps
  - Documentation
- Create expected result spreadsheets (where applicable)
- Define test success criteria
- Write test procedures
- Conduct an internal "peer" review

ATDWG Test Board Review:

ATDWG Test Board Review will be scheduled after a test procedure has been developed. The review includes the following activities:

- Attend review and present test cases and procedures
- Incorporate comments into test case description and/or test procedure
- Follow-up on any review generated action items

Execute Tests:

This step consists of the following activities:

- Schedule test dates
- Coordinate lab times on a daily basis and fill in the Test Calendar
- Submit Briefing messages for supporting entities.
- Conduct test(s), collect and place results and a hardcopy of the as-run test procedure in the test folders.
- Submit or update problem reports as necessary
- Report problems to AQ GS leads and status at appropriate meetings

The following procedure will be used for writing test results and new problem reports.

- Log enough useful information to clearly document the results of the test. Document any problems, issues, redlines to procedures or deviations from the procedure, or workarounds.
- Identify any problem reports written as a result of the test.
- Submit a new Problem Report (PR) whenever a problem that is not currently documented in an existing PR is encountered. Make sure to:
  - Confirm failure with the developer
  - Report the failure
- If a fix to an existing PR fails:
  - Confirm failure with the developer

- Report the failure at the appropriate meeting

Complete Test Folders:

The test folder will contain a redlined copy as well as a corrected/updated copy of the test procedure. Test folders will be submitted to QA upon test completion.

5. Organization, Roles, and Responsibilities

5.1 Mission Organization

The Aquarius/SAC-D Mission will be managed in accordance with the Aquarius/SAC-D Project Implementation Plan (PIP) [JPL D-28220] and in compliance with the NASA policy guide for project management (NPG 7120.5C) and the NASA-CONAE Memorandum of Understanding, dated 2 Mar 2004.

5.2 Aquarius/SAC-D Responsibility and Authority

The responsibilities for the Aquarius/SAC-D Ground System are divided across CONAE and GSFC. CONAE is responsible for developing, testing and operating the SAC-D Ground System and for identifying the interfaces that the Aquarius Ground System must design to. GSFC is responsible for developing, operating, and testing the Aquarius Ground System and for implementing CONAE's interface design specifications. Aquarius Ground System Roles and Responsibilities are delineated here.

5.3 Aquarius Ground System Manager Responsibilities

The Aquarius Ground System Manager directly leads the development, integration and test of the Aquarius Data Processing Segment of the Aquarius Ground System including interfaces with the ACCS, the PO.DAAC and the AVDS. The Aquarius Ground System Manager also oversees the development, integration and test of the ACCS and its interfaces with SAC-D Ground System. Additionally, this role includes oversight of the Project System Level Agreement between CONAE and the NASA Ground Network.

Post launch, the development role of the Aquarius Ground System Manager transfers to the operations role, with ultimate responsibility for the health, control, and data collection of the Aquarius instrument, and for the archive, processing, and distribution of science products.

Responsibilities:

- Oversee Aquarius Ground System technical coordination and planning
- Oversee Aquarius Ground System Level 3 and 4 Requirements
- Identify and coordinate development of ADPS and ACCS interfaces
- Coordinate implementation and test of Aquarius science processing algorithms
- Ensure ADPS collection, archive, processing and distribution implementation satisfies Level 2B Science Requirements.

- Ensure ACCS monitoring and control of Aquarius satisfies Level 2 Science Requirements
- Coordinate integration of Aquarius controlled information into Ocean Biology Processing System configuration control

5.4 Aquarius Ground System Engineer Responsibilities

The AQ Ground System Engineer, acting under the authority of the AQ Ground System Manager, leads the design, development, interface implementation, and test efforts for the ACCS component of the AQ Ground System. Interface specifications are designated in the CONAE document AS-336-0151c, the Aquarius-SAC-D Ground System Interface Control Document.

Responsibilities:

- Lead Aquarius Ground System ACCS technical coordination and planning
- Lead Aquarius Mission Operations technical coordination and planning
- Generate Aquarius ACCS/Mission Operations Ground System Level 3 and derived Requirements
- Develop Aquarius ACCS/Mission Operations Ground System Verification and Validation Matrix
- Implement Aquarius Ground System interface definition
- Develop and test Aquarius ACCS Ground System tools
- Develop and test Aquarius ACCS standard and contingency procedures and processes
- Develop and implement Aquarius ACCS Ground System Integration, Test and Training Plan
- Support Aquarius/SAC-D Mission Scenario and interface testing
- Integrate into the Aquarius Ground System the Aquarius instrument commands, telemetry, alarm settings, engineering unit conversion equations, trend and analysis tools, and flight constraints as provided by the Aquarius instrument team.
- Ensure Aquarius health monitoring and control via the ACCS satisfies Level 2 Science Requirements
- Establish configuration control for all Aquarius Command and Control System and Mission Operations documents, scripts, and tool versions.
- Support Aquarius test-bed planning

5.5 Aquarius Ground System ADPS Lead Responsibilities

The Aquarius Ground System ADPS Lead is responsible for the development and test of AQ GS segments that perform Aquarius science data processing. Here, “ADPS” also includes processes, tests and tools that cover PO.DAAC interfaces.

Responsibilities:

- Lead Aquarius Ground System ADPS technical coordination and planning
- Develop the Aquarius Software Development Plan.
- Generate Aquarius ADPS Ground System Level 4 and Requirements
- Develop Aquarius ADPS Ground System Verification and Validation Matrix
- Implement ADPS interface definitions for the ACCS and PO.DAAC
- Lead the development and test of ADPS segments and the integration and test of the system.
- Develop and test ADPS processes
- Support Aquarius/SAC-D interface testing
- Ensure Aquarius science data processing satisfies Level 2 Science Requirements
- Establish configuration control for all ADPS documents and tools.

6. Test Configuration Management

The Aquarius Ground System Manager establishes the development, test, and implementation schedule for Aquarius Ground System software components. The components include (but are not limited to):

ADPS

- Data retrieval, archive and processing scheduling scripts – internal builds
- Level 0 to Level 1A processing code – internal build
- Level 1B through Level 3 algorithms – science team deliverables
- AVDS matching code – internal build
- Data distribution scripts including PO.DAAC interface scripts – internal builds

ACCS

- SAC-D Command, Monitoring, and Scheduling Tools – CONAE deliverables
- Aquarius telemetry processing scripts – internal build
- Aquarius command scripts – internal build
- Aquarius Command Planning Tool
- Aquarius Analysis Tool

6.1 Change Control Process

Overall responsibility for change management on the AQ project is governed by the GSFC Ocean Biology Processing Group Configuration Management Plan.

6.1.1 AQ GS Software Delivery

In the case of each component, the build to be delivered is reviewed by the Aquarius Ground System Programmer-Analyst team and, if appropriate, the Aquarius Science Team. The review is led by the Aquarius Ground System Manager.

6.1.2 AQ GS Software Test

If the build is approved, it is installed into the Aquarius Ground System (ACCS or ADPS) Test Environment.

Because the ADPS is an established data processing system, a suite of analyses are available to be run to verify each component's performance. Also, ADPS builds will be implemented within the test environment in order; Level 0 to Level 1A code, then successive Levels through the final product, Level 3. The Aquarius Ground System Programmer-Analysts will track and report on testing. Results are displayed via the Ocean Biology Processing Group website for peer review and comments. The final step in testing is to hold an internal peer review.

When a new project such as Aquarius is integrated into the Ocean Biology Processing System, the full component suite remains in the test environment until all system level tests have been completed. Only then is the new project promoted to the operations environment. In the case of the ACCS, the test environment will be maintained on the backup ACCS computer.

After the initial Aquarius build, there will be a shift from a "build delivery" focus to a "capabilities delivery" focus in which only a small element of the overall component or system is updated at any one time. These updates might include internal optimizations (internal refers to the Ocean Biology Processing Group science staff), algorithm improvements from project science teams, improvements as a result of internal analysis of data products or external recommendations from users. Project scientists (Principal Investigators) and internal scientists work together to ascertain whether the recommended update is needed. This same team will also review and approve testing and promotion if the update is selected for implementation.

Because the Ocean Biology Processing System serves multiple projects, there is generally a test queue in process. Any Aquarius updates would be entered into this queue. Tests are prioritized, a test configuration is generated for each then a final test schedule is created and implemented. Test scenarios are devised, typically by creating a 1 week per month sub-sample scenario applicable to the mission in question. Results are directly compared to operational data products during the review process.

6.1.3 AQ GS Software Deployment to Operations

If approved for operations implementation, the code is promoted from the test to the operations environment. The schedule for implementation is established by the Aquarius Ground System Manager. The new code is also entered into configuration control under the direction of the Ocean Biology Processing Group Configuration Control Manager.

After Aquarius system code has undergone promotion to the operations environment, simulated data will be run through the system to continue to monitor and verify performance. This is planned to take place for at least one full year prior to AQ/SAC-D launch.

In the event that code continues to be optimized or updated (which is typical) either during pre-launch testing or post-launch, the same process will be applied for testing and promoting code. If Aquarius science algorithms are being changed or impacted, the Aquarius Principal Investigator will be included in the review and approval team.

6.1.4 AQ GS Configuration Control

All code and documentation including operations scripts and procedures are placed under configuration control using Subversion configuration management software. Subversion offers web-based access; this allows shared configuration control of selected files between the AQ GS and CONAE. Documents such as AQ command and telemetry dictionaries, SAC-D telemetry scripts, and CONAE procedures for AQ operations will be included in the shared folder.

Any AQ GS-CONAE shared materials under configuration control that are updated (whether additions, modifications or deletions) shall be exported from the AQ GS to the CONAE FOT Configuration Manager for update under the MOC configuration control system. After completing the MOC update, the CONAE FOT Configuration Manger will notify the AQ GS via email (accs@seawifs.gsfc.nasa.gov) that the update is complete as of the update date/time.

7. Anomaly Reporting

Each anomaly detected during testing shall be briefly analyzed at the post-test briefing, and noted in the preliminary test report. If a failure is suspected, an individual will be assigned to complete the analysis, and generate an appropriate anomaly report. Anomaly report identifiers and criticality assignments shall be included in the final test report. All workarounds utilized during testing shall be identified.

7.1 Problem Failure Reporting

The AQ GS generates its own problem report forms. See Appendix B for the template.

7.2 Criticality classes

The criticality classes for identified problems are defined as:

1)- Unacceptable Risk:

A problem, which precludes, or represents **unacceptable risk** to achieving defined objectives and for which there is no workaround procedure.

2)- Acceptable Risk:

A problem that represents **accepted risk** to achieving defined objectives by the use of an approved but rigorous workaround procedure.

3)- No Significant Risk:

A problem that represents **no significant risk** to achieving defined objectives but that is planned to be corrected.

4)- No Risk:

A problem that represents **no risk** to achieving defined objectives that are planned not to be corrected.

8. Risk Retirement/Mitigation

The Aquarius Ground System performs risk retirement/mitigation by:

- Identifying and understanding any risks
- Early and extensive end to end testing
- Scheduling extensive test time
- Working closely with the subsystem developers to develop test regimens that complement each other, especially in areas of risk.

- Working on engineering versions of software and identifying anomalies early
- Regression testing
- By using consistent procedures during each delivery phase.
- Expansion of test procedures and verisimilitude of test data as the system progresses.
- Performing tests with a setup as close as possible to operations following test-as-you-fly principles

9. Aquarius Ground System Test List

9.1 Complete Test List

Component Tests:

- ACCS equipment, AGS-CCS-C-001
- Telemetry Viewer scripts and pages, AGS-CCS-C-002
- SInter scripts, AGS-CCS-C-003
- Command Planning Tool, AGS-CCS-C-004
- AQ Configuration Tracking Tool, AGS-CCS-C-005
- AQ Analysis Tool, AGS-CCS-C-006
- Alarm and Error Notification Tool, AGS-CCS-C-007
- ADPS Retrieval, Scheduling and Archiving Test, AGS-DPS-C-001
- ADPS Level 0 to 1A Processing Test, AGS-DPS-C-002
- ADPS Level 2 Algorithm Test, AGS-DPS-C-003
- ADPS Level 3 Algorithm Test, AGS-DPS-C-004

Interface Tests:

- ACCS-ADPS Interface Test, AGS-I-001
- ADPS-PO.DAAC interface test, AGS-I-002
- Science data delivery SDGS-GSD-I-0042-a
- ST TM delivery SDGS-GSD-I-0044-a
- AR Reception and Confirmation Integration Test SDGS-GSD-I-0024-a
- Action Reports Request and Response Integration Test SDGS-GSD-I-0025-a
- Voice Communication Integration Test SDGS-GSD-I-0028-a

System Tests and Scenarios:

For the list and description of the AQ SAC-D System Tests and Scenarios, refer to the document: AQ SAC-D Mission System Test Plan.

9.2 Test Descriptions

This section provides a high level description of each Aquarius Ground System test case including methods, pass/fail criteria, and required resources. Tests performed jointly with CONAE are indicated with the matching box shown in Figure 9.2.1. Each joint test set falls within one of the green boxes.

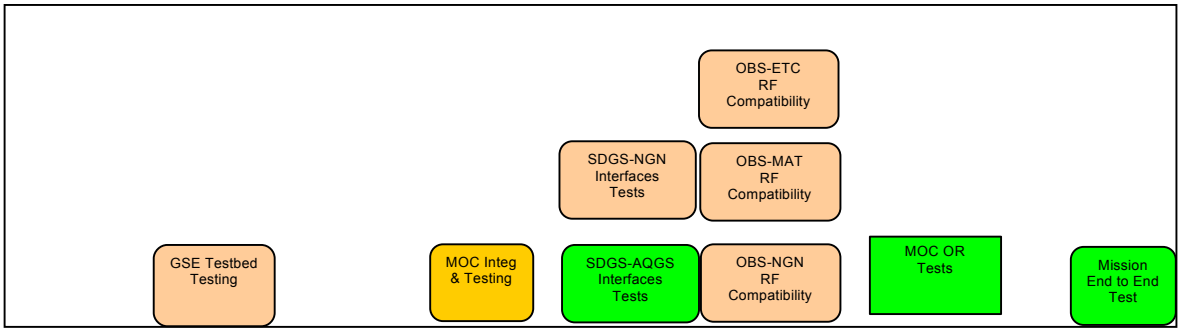

Figure 9.2.1. High Level SAC-D GS Test Plan. Elements in green indicate joint SAC-D-AQ GS Tests

9.2.1 Component Tests:

i. ACCS Equipment Test, AGS-CCS-C-001

Test Purpose :

Verify that the Level 4 Requirements that apply to the ACCS primary and backup computer are satisfied.

Applicable Level 4 Requirements:

The ACCS primary and backup computers shall include the CONAE payload interface tool to support submitting commands to the SAC-D Spacecraft Operations Planning System.
The ACCS primary and backup computers shall include an Internet browser.
The ACCS primary and backup computers shall include an email utility.
The ACCS equipment shall include standard telephone capable of international dial-up services.
The ACCS primary and backup computers shall display UTC time.
The ACCS primary and backup computers shall be synchronized to Goddard System time to within 1 second.
The CONAE Telemetry Viewer tool and associated scripts and pages shall be installed on the primary and backup computers.

Prerequisite Tests

None.

Test Cases

Test Case 1:

Ensure that the correct software and utilities are loaded onto both the primary and backup ACCS computers:

- Scheduler Client Tool
- Telemetry Viewer
    - Loaded with the most recent version of telemetry scripts
    - Loaded with the most recent version of telemetry pages
- An Internet Browser
    - Compatible with CONAE's scheduling website
- An email utility
- AQ Configuration Tracking tool
- AQ Command Planning Tool

Test Case 2:

Ensure that a standard telephone is available to the ACCS Operator with international dial-up capability.

Test Case 3:

Verify that both the primary and backup computers are synchronized to Goddard System time to within one second.

Test Case 4:

Verify the both the primary and backup computers display time in UTC format.

Pass Criteria

Each of the following software/utility components must be present:

- Payload Scheduling Tool
- Telemetry Viewer
- Telemetry scripts (TSL)
- Telemetry pages (Aquarius_All.htm)
- Internet Browser
- Email
- Configuration Tracking Tool
- Command Planning Tool

Each of the above components must have the same version loaded onto the ACCS as is indicated in the Configuration Management Tool.

The ACCS Operations staff must be able to contact the CONAE MOC flight operations team via readily accessible phone.

Both the primary and backup ACCS computers must indicate system times that are within one second of Goddard system time.

Both the primary and backup ACCS computers must display time in UTC format

Test Location(s): Goddard only

Test data: none

Test equipment: no additional equipment required

Personnel: one test conductor, one test reviewer

Duration: one day

ii. Telemetry Viewer Scripts and Pages, AGS-CCS-C-002

Test Purpose : Verify that the Level 4 Requirements that apply to the ACCS Telemetry Viewer scripts and pages are satisfied.

Applicable Level 4 Requirements:

- Telemetry Viewer scripts shall be established for each Aquarius mode, configuration, and format as adopted from instrument Integration and Test procedures.
- Telemetry Viewer scripts shall include the conversion of GPS time from Aquarius telemetry to UTC time.
- Telemetry Viewer pages shall include the display of UTC time.
- The ACCS Telemetry Viewer Aquarius HKT hex to EU script conversions shall be identical to those implemented in the Aquarius I&T Test Conductor Telemetry Viewer scripts.
- The SAC-D HKT hex to EU conversions implemented in the ACCS Telemetry Viewer shall be identical to those implemented in the CONAE MOC scripts.
- The ACCS Telemetry Viewer shall be capable of ingesting and displaying all S/P HKT.
- The ACCS Telemetry Viewer pages shall be capable of displaying all S/P HKT.
- The ACCS Telemetry Viewer shall be capable of displaying and trending all Aquarius HKT and all SAC-D HKT.
- The ACCS Telemetry Viewer scripts shall implement alarm settings for HKT according to the Aquarius telemetry dictionary.
- The ACCS Telemetry Viewer scripts shall implement alarm settings for science data according to the Aquarius Instrument Operations Handbook.
- The ACCS Telemetry Viewer tool shall be capable of processing all Observatory telemetry
- The ACCS Telemetry Viewer tools shall process Aquarius software messages, boot log messages, and memory download data.
- The ACCS Telemetry Viewer tool shall parse and display Aquarius HKT software messages.
- The ACCS Telemetry Viewer tool shall parse and display Aquarius HKT bootlog messages.
- The ACCS Telemetry Viewer tool shall parse and display ICDS memory downloads.

Test Cases

Test Case 1.

Requirements in this Test Case:

- Telemetry Viewer scripts shall be established for each Aquarius mode, configuration, and format as adopted from instrument Integration and Test procedures.

- The ACCS Telemetry Viewer tools shall process Aquarius software messages, boot log messages, and memory download data.

- The ACCS Telemetry Viewer tool shall parse and display Aquarius HKT software messages.

- The ACCS Telemetry Viewer tool shall parse and display Aquarius HKT bootlog messages.
- The ACCS Telemetry Viewer tool shall parse and display ICDS memory downloads.

Verify all telemetry displays for each defined mode, configuration and format. For Housekeeping Telemetry these include all Telemetry Items as identified in the Aquarius Telemetry Dictionary. The Telemetry page set, "Aquarius_all" should provide every possible point. The test data file(s) must include examples of each of the following instrument events/configurations:

- Deployment
- Flight Software loads
- At least one instrument startup
- At least one instrument shutdown
- nominal science mode (preferably during on-orbit environmental conditions)
- Radiometer only
- One Radiometer of the 3 only
- Scatterometer only

Test Case 2.

Requirements in this Test Case:

- Telemetry Viewer scripts shall include the conversion of GPS time from Aquarius telemetry to UTC time.
- Telemetry Viewer pages shall include the display of UTC time.

Verify that each page displays both GPS and UTC time and that the conversion is correct.

Test Case 3.

Requirements in this Test Case:

- The ACCS Telemetry Viewer shall be capable of ingesting and displaying all S/P HKT.
- The ACCS Telemetry Viewer pages shall be capable of displaying all S/P HKT.
- The ACCS Telemetry Viewer shall be capable of displaying and trending all Aquarius HKT and all SAC-D HKT.
- The ACCS Telemetry Viewer tool shall be capable of processing all Observatory telemetry

CONAE will deliver SAC-D and SAC-D instrument telemetry pages, scripts, and test data from the Observatory testing (during ATLO). Aquarius I&T versions of telemetry pages, scripts and data sets are available from Aquarius instrument testing. For this test case, every Observatory telemetry point must be displayed from the pertinent data set and recorded for both the ACCS scripts and pages and the comparison system scripts and pages. The comparison system will be one of: CONAE or Aquarius instrument I&T. A representative sample set of data must also be trended on the ACCS tools.

Pass/Fail Criteria:

Test Case 1: The test data sets obtained from Aquarius instrument I&T must identify frames that include data from the specified configurations. I&T logs (alarm, software, bootlog) will provide adequate comparison of data points between I&T displays and ACCS displays. All available comparison points must match in order to pass this test.

Test Case 2: Each page must display time in both GPS and UTC formats. The GPS data must be compared to an external source (such as Aquarius I&T analysis tool data) to confirm its translation from raw hexadecimal format to day/time format is correct. Likewise the UTC translation from GPS must be confirmed as correct.

To pass this test, both GPS and UTC data must be displayed on all telemetry pages; the GPS translation from raw must be correct; the UTC translation from GPS must be correct.

Pre-requisite Tests: ACCS Equipment

Test Location(s): Goddard only

Test data: Observatory ATLO test files; Aquarius thermal-vacuum test files

Test equipment: none

Personnel: one test conductor at each site, one test reviewer

Duration By Test Case: 3 days; 1 day; Total 4 days.

i. Cross-tool Verification, AGS-CCS-C-003

Test Purpose: Verify that the Level 4 Requirements that ensure data is interpreted consistently across team platforms are satisfied.

Applicable Level 4 Requirements:

- The ACCS Telemetry Viewer Aquarius HKT hex to EU script conversions shall be identical to those implemented in the Aquarius I&T Test Conductor Telemetry Viewer scripts.
- The SACD HKT hex to EU conversions implemented in the ACCS Telemetry Viewer shall be identical to those implemented in the CONAE MOC scripts.
- The ACCS Telemetry Viewer scripts shall implement alarm settings for HKT according to the Aquarius telemetry dictionary.

Test Cases

Test Case 1.

Requirements in this Test Case:

- The ACCS Telemetry Viewer Aquarius HKT hex to EU script conversions shall be identical to those implemented in the Aquarius I&T Test Conductor Telemetry Viewer scripts.
- The SAC-D HKT hex to EU conversions implemented in the ACCS Telemetry Viewer shall be identical to those implemented in the CONAE MOC scripts.

Test Case 2.

Requirements in this Test Case:

- The ACCS Telemetry Viewer scripts shall implement alarm settings for HKT according to the Aquarius telemetry dictionary.

Pass/Fail Criteria:

Test Case 1: In order to pass this test, every Observatory telemetry point displayed by the Aquarius ACCS for a given test data frame must match the comparison test data point with which it correlates (Aquarius I&T or CONAE data).

Test Case 2: Every telemetry point that passes through an alarm setting as expressed via the Aquarius I&T HKT tools must trigger at the identical value(s) as expressed by the ACCS HKT tool in order to pass this test.

Pre-requisite Tests: Telemetry Viewer Scripts and Pages, AGS-CCS-C-002

Test Location(s): Goddard, CONAE MOC

Test data: Simulated HKT

Test equipment: none

Personnel: one test conductor, one test reviewer

Duration By Test Case 1 days; 1 days. Total 2 days.

ii. Command Planning Tool, AGS-CCS-C-004

Test Purpose: Verify that the Level 4 Requirements that apply to the ACCS Command Planning Tool are satisfied.

Applicable Level 4 Requirements:

- The ACCS Command Planning Tool shall maintain a log of commands planned via the CONAE Spacecraft Operations Planning System.
- The ACCS Command Planning Tool shall monitor the CONAE Spacecraft Operations Planning System via the Payload User Software for receipt of the Feasibility Report.
- The ACCS Command Planning Tool shall monitor the CONAE Spacecraft Operations Planning System via the Payload User Software for receipt of the Command Acceptance Report.
- The ACCS Command Planning Tool shall monitor the CONAE Spacecraft Operations Planning System via the Payload User Software for receipt of the Pass Plan.
- The ACCS Command Planning Tool shall monitor the CONAE Spacecraft Operations Planning System via the Payload User Software for receipt of the Execution Report.
- The ACCS Command Planning Tool shall automatically re-schedule any planned commands upon receipt of a failure notification from the Feasibility, Acceptance, Pass Plan Report, or Execution Reports.
- The ACCS Command Planning Tool shall generate a final report on the results of its command verification that includes the Feasibility, Acceptance, Pass Plan, Execution, and telemetry verification reports.
- The ACCS Command Planning Tool shall notify the Operator in the event of the receipt of any Spacecraft Planning System report or an internal verification report.
- The ACCS Command Planning Tool shall internally archive all received and internally generated planning reports.
- The ACCS Command Planning Tool shall utilize UTC time for all planning and reporting.
- The ACCS Command Planning Tool shall be sized to accommodate all software, files, and reports to be generated during the design life of the Aquarius instrument.
- The ACCS Command Planning Tool shall restrict Cold Sky Calibration request lead times to at least 21 days in advance of the maneuver.
- The ACCS Command Planning Tool shall ensure that all command restrictions are implemented within each command plan in accordance with the command restrictions document, AQ-385-0111 Aquarius Instrument Flight Rules, Constraints, & Idiosyncrasies.
- The ACCS Command Planning Tool shall plan all real time commands to the Aquarius instrument
- The ACCS Command Planning Tool shall plan all time tagged commands to the Aquarius instrument.

Test Cases

Test Case 1:

This test will encompass all of the Level 4 Requirements for the Command Planning Tool. The test will simulate a "month in the life" of Aquarius in order to capture the daily loads and the Cold Sky Calibration scheduling. However, it will also include the following:

- Each Aquarius command planned as realtime
- Each Aquarius command planned as time-tagged
- A FSW patch with one 59 byte command
- Seasonal setpoint changes.
- A DPU memory download
- An ICDS memory download (a "peek" command)
- An ICDS reset
- One configuration change (such as switching off the Scatterometer)
- One format change (command a DPU LUT switch)
- One DPU LUT upload

Pass/Fail Criteria: The following are required to pass Test Case 1:

The ACCS Command Planning Tool will:

Maintain a completely accurate log of commands planned via the CONAE Spacecraft Operations Planning System.

Receive, archive, and announce to the operator the arrival of all of the scenario's Feasibility Reports

Command Acceptance Reports

Pass Plan Reports

Execution Reports

The test case will simulate a failure of each of the reports to be delivered at various times. The ACCS Command Planning Tool must automatically re-schedule any planned commands upon receipt of a failure notification from the Feasibility, Acceptance, Pass Plan Report, or Execution Reports.

The ACCS Command Planning Tool must correctly compare (simulated) telemetry to expected telemetry changes to verify the execution of the pass plan under test.

The ACCS Command Planning Tool must generate a final report on the results of its command verification that includes the Feasibility, Acceptance, Pass Plan, Execution, and telemetry verification reports.

The ACCS Command Planning Tool must notify the Operator of each Final Report.

The ACCS Command Planning Tool must archive each Final Report.

UTC time must be used for all planning and reporting products.

The test will attempt to schedule a Cold Sky Calibration request less than 21 days in advance of the maneuver. The ACCS Command Planning Tool must reject that request.

The ACCS Command Planning tool must correctly schedule:

- nominal downloads
- setpoint changes
- flight software patches
- DPU memory downloads
- ICDS memory downloads
- planned ICDS resets
- instrument mode or configuration changes
- format changes (DPU LUT)
- Cold Sky calibration maneuver requests

The ACCS Command Planning Tool must correctly implement selected command restrictions at both the individual command level (parameter ranges) as well as the script level (e.g., command order).

The ACCS Command Planning Tool must successfully plan all commands to the Aquarius instrument, including at least 3 real-time and at least 3 time-tagged.

Pre-requisite Tests: ACCS Equipment, Telemetry Viewer

Test Location(s): Goddard

Test data:

- Simulated Action Reports from CONAE that demonstrate both correct scheduling responses (all requested commands successfully scheduled) and faults (unable to schedule at least one command). This allows the scheduling report function to be fully tested.
- A Flight Software Patch with a series of commands, one of which is 59 bytes.

Test equipment: none

Personnel: one test conductor, one test reviewer, CONAE support in providing simulated Action Reports.

Duration: 3 days

iii. AQ Configuration Tracking Tool, AGS-CCS-C-005

Test Purpose: Verify that the Level 4 Requirements that apply to the AQ Configuration Tracking Tool satisfied.

Applicable Level 4 Requirements:

- The ACCS AQ Configuration Tracking Tool shall track Aquarius ICDS register states per the recommendation of section 3.2 of the Aquarius Flight Rules, Constraints and Idiosyncrasies documents, AQ-385-0111.
- The Aquarius Configuration Tracker shall track the configuration of the Aquarius test bed.
- The AQ Configuration Tracking tool shall compare telemetered ICDS register states to the last commanded states.
- The AQ Configuration Tracking Tool shall display inconsistencies between ICDS register states and the last commanded states.
- The AQ Configuration Tracking tool shall display the Aquarius mode, configuration or format as defined in the Aquarius Instrument Requirements Document, AQ-325-0112.

Test Cases:

Test Case 1

This test case will verify the following Level 4 Requirements:

- The ACCS AQ Configuration Tracking Tool shall track Aquarius ICDS register states per the recommendation of section 3.2 of the Aquarius Flight Rules, Constraints and Idiosyncrasies documents, AQ-385-0111.
- The Aquarius Configuration Tracker shall track the configuration of the Aquarius test bed.
- The AQ Configuration Tracking tool shall compare telemetered ICDS register states to the last commanded states.
- The AQ Configuration Tracking Tool shall display inconsistencies between ICDS register states and the last commanded states.
- The AQ Configuration Tracking tool shall display the Aquarius mode, configuration or format as defined in the Aquarius Instrument Requirements Document, AQ-325-0112.

Verify Aquarius instrument telemetry is processed by the Configuration Tracking Tool. Using instrument integration and test logs, verify that the ICDS register states that were set during this I&T data set collection are correctly displayed, alarmed and reported by the Configuration Tracking Tool. Verify that the reported and displayed times are consistent with the I&T logs.

Pass/Fail Criteria:

Test Case 1

The Configuration Tracking Tool will provide an expected configuration file for each configuration identified by the I&T logs. All data processed through the Alarm Log is also processed through the Configuration Tracking Tool. All telemetry changes are correctly compared against the expected state, are reported to the user, and are archived.

Pre-requisite Tests: ACCS Equipment

Test Location(s): Goddard

Test data: I&T playback files containing each known AQ configuration.

Test equipment: None.

Personnel: one test conductor, one test reviewer

Duration: 3 days

iv. AQ Analysis Tool, AGS-CCS-C-006

Test Purpose: Verify that the Level 4 Requirements that apply to the AQ Analysis Tool are satisfied.

Applicable Level 4 Requirements:

- The AQ Analysis Tool shall automatically process all science and HKT files received from the ADPS.
- The AQ Analysis Tool shall be capable of displaying and trending all Aquarius high rate data, all Aquarius HKT, and all SACD HKT.
- The ACCS AQ Analysis Tool shall parse and display DPU memory downloads.
- The AQ Analysis Tool shall be capable of processing science and HKT files of maximum size within one hour of reception.
- The Analysis Tool Alarm Log shall log all alarm events from Aquarius or SACD data.
- For each alarm event, the Analysis Tool Alarm Log shall list the time, the EU value of the telemetry point, and the alarm threshold crossed (red high/low, yellow high/low, green).
- The ACCS AQ Analysis Tool shall implement EU conversions for HKT according to the Aquarius telemetry dictionary.
- The ACCS AQ Analysis Tool shall implement alarm settings for HKT according to the Aquarius telemetry dictionary.
- The ACCS AQ Analysis Tool shall implement alarm settings for science data according to the Aquarius Instrument Operations Handbook.
- The Aquarius Analysis Tool shall display data and system time tags in UTC.
- The Aquarius Analysis Tool shall time-stamp reports in UTC.
- The Alarm Log shall time tag events in UTC.
- The Aquarius Analysis Tool shall provide the capability of generating science and HKT graphs interactively.
- The Aquarius Analysis Tool shall provide the capability of generating science and HKT graphs at various levels of data resolution in order to support: daily, weekly, monthly, yearly, or mission length trends.

Test Case 1

Requirements Verified

- The AQ Analysis Tool shall automatically process all science and HKT files received from the ADPS.
- The AQ Analysis Tool shall be capable of displaying and trending all Aquarius high rate data, all Aquarius HKT, and all SACD HKT.
- The ACCS AQ Analysis Tool shall parse and display DPU memory downloads.

- The AQ Analysis Tool shall be capable of processing science and HKT files of maximum size within one hour of reception.

The automatic retrieval portion of the first listed requirement will be verified within the interface test AGS-I-001. This test will launch from the point where the test file is loaded into the receive directory for the AQ Analysis Tool. The L1A test data file(s) is (are) to include: typical Aquarius and SAC-D HKT, Aquarius science, alarm conditions, software messages, at least one DPU memory download, and actual or simulated SAC-D instrument data. The file is to equate to a full Aquarius and SAC-D stored data buffer download in order to support maximum file size testing.

Test Case 2

Requirements Verified

- The Analysis Tool Alarm Log shall log all alarm events from Aquarius or SACD data.
- For each alarm event, the Analysis Tool Alarm Log shall list the time, the EU value of the telemetry point, and the alarm threshold crossed (red high/low, yellow high/low, green).

Test Case 3

Requirements Verified

- The ACCS AQ Analysis Tool shall implement EU conversions for HKT according to the Aquarius telemetry dictionary.
- The ACCS AQ Analysis Tool shall implement alarm settings for HKT according to the Aquarius telemetry dictionary.
- The ACCS AQ Analysis Tool shall implement alarm settings for science data according to the Aquarius Instrument Operations Handbook.

Test Case 4

Requirements Verified

- The Aquarius Analysis Tool shall display data and system time tags in UTC.
- The Aquarius Analysis Tool shall time-stamp reports in UTC.
- The Alarm Log shall time tag events in UTC.

Test Case 5

Requirements Verified

- The Aquarius Analysis Tool shall provide the capability of generating science and HKT graphs interactively.
- The Aquarius Analysis Tool shall provide the capability of generating science and HKT graphs at various levels of data resolution in order to support: daily, weekly, monthly, yearly, or mission length trends.

Pass/Fail Criteria:

Test Case 1

The test file(s) automatically begin processing within 10 seconds of being placed in the retrieve directory. Automated graphs are displayed that include Aquarius and SAC-D HKT and Aquarius

science data. Any DPU memory download is automatically displayed. All HKT, science and download data values are correct. All automatic displays and graphs are completed within one hour of the start of processing.

Test Case 2

The AQ Analysis Tool Alarm Log values and threshold crossings will exactly match those of the ACCS Alarm Log for a given test file. (The ACCS Alarm Log has been repeatedly verified during JPL instrument testing.)

Test Case 3

Each Analysis Tool alarm setting must be compared to the appropriate reference; the Aquarius Telemetry Dictionary, the SAC-D Telemetry Dictionary or the Aquarius Operations Handbook, and verified to match.

Test Case 4

All Analysis Tool time displays, including the Alarm Logs, must display in UTC format.

Test Case 5

The test conductor must be able to interactively graph any chosen Aquarius science or HKT point or any SAC-D HKT point in any of the following resolutions: daily, weekly, monthly, yearly, or mission length (3 year).

Pre-requisite Tests: none

Test Location(s): Goddard

Test data: At least one L1A test data file(s) that is (are) to include: typical Aquarius and SAC-D HKT, Aquarius science, alarm conditions, software messages, at least one DPU memory download, and actual or simulated SAC-D instrument data. The file is to equate to a full Aquarius and SAC-D stored data buffer download in order to support maximum file size testing.

Test equipment: none

Personnel: one Analysis Tool engineer, one test conductor, one test reviewer

Duration: 3 days

v. Alarm and Error Notification Tool, AGS-CCS-C-007

Test Purpose: Verify that the Level 4 Requirements that apply to the Alarm and Error Notification Tool are satisfied.

Applicable Level 4 Requirements:

- The Alarm and Error Notification Tool shall monitor for expected Level 0 files from CONAE according to the pass schedule.
- The Alarm and Error Notification Tool shall provide notification of any file that has not been received within 10 minutes of expected.
- The Alarm and Error Notification Tool shall provide notification of any file containing a checksum error.
- The Alarm and Error Notification Tool shall provide automatic notification of all file errors to the on-call staff member(s).
- The Alarm and Error Notification Tool shall provide automatic notification of all detected alarms to the on-call staff member(s).
- The Alarm and Error Notification Tool shall recognize alarm events as the AQ Analysis Tool processes a file.
- The Alarm and Error Notification Tool shall notify the Operations team of an alarm event within 5 minutes of processing that event.

Test Case 1

Set the Alarm and Error Notification Tool set to expect new files every 15 minutes, and to notify selected test staff via both email and pager. Have the ADPS retrieve files, with and without checksum errors, from the CONAE CUSS server. Have the Analysis Tool set to process incoming files. Ensure incoming files contain alarmed data.

Pass/Fail Criteria:

Test Case 1

The Alarm and Error Notification Tool will send notifications of any files with bad checksums or files not received within 10 minutes of expected to all targets (email, pager). It will send alarm notifications to all targets within 5 minutes of the time each event was processed by the Analysis Tool. It will not send false notifications for alarms, bad checksums, or for late files.

Pre-requisite Tests: ACCS-ADPS File Exchange Test, CUSS-ADPS File Exchange Test, Level 0 to Level 1A processing bench test, AQ Analysis Tool component test.

Test Location(s): Goddard

Test data: multiple Level 0 files, at least 1 having an incorrect checksum

Test equipment: none

Personnel: One CONAE engineer, one ADPS engineer, one test conductor, one test reviewer.

Duration: Two days

vi. ADPS Retrieval, Scheduling and Archiving Test, AGS-DPS-C-001

Test Purpose: Verify that the L3 Requirements that apply to the ADPS Retrieval, Scheduling and Archiving are satisfied.

Applicable Level 3 Requirements:

- The ADPS shall log received Level 0 raw science data as described in the AQ GS Data Processing System Plan.
- The ADPS shall log received Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.
- The ADPS shall log received Service Platform telemetry including Observatory attitude data as described in the AQ GS Data Processing System Plan.
- The ADPS shall log received ephemeris data as described in the AQ GS Data Processing System Plan.
- The ADPS shall manage received Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.
- The ADPS shall archive received Level 0 raw science data as described in the AQ GS Data Processing System Plan.
- The ADPS shall archive received Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.
- The ADPS shall archive received Service Platform telemetry including Observatory attitude data as described in the AQ GS Data Processing System Plan.
- The ADPS shall archive received ephemeris data as described in the AQ GS Data Processing System Plan.

Test Cases:

This test can be run in conjunction with the interface test ST TM delivery SDGS-GSD-I-0044-a and Science data delivery SDGS-GSD-I-0042-a, as a single test event.

Test Case 1

Stage simulated downlink files (HRD and HKT) for one day (four or five CONAE passes) and the corresponding daily SAC-D ephemeris on FTP site to be acquired by the ADPS (if this is the CONAE site, then the data acquisition is performed via interface tests SDGS-GSD-I-0044-a and SDGS-GSD-I-0026-a). ADPS will acquire, ingest and catalog all staged data files.

Test Case 2

Same as Case 1, for seven consecutive days.

Pass/Fail Criteria:

Test Case 1

All staged data files acquired, ingested and cataloged by ADPS.

Test Case 2

Same as Case 1, for all 7 days (103 orbits) of data.

Pre-requisite Tests: None.

Test Location(s): Goddard

Test data: Simulated Aquarius science packets, Simulated Observatory HKT, ephemeris.

Test equipment: none

Personnel: One data system software engineer, one test reviewer

Duration: XX days

vii. ADPS Level-0-to-1A Processing Test, AGS-DPS-C-002

Test Purpose: Verify that the L3 Requirements that apply to the ADPS Level 0 to Level 1A processing are satisfied.

Applicable Level 3 Requirements:
The ADPS shall process received Level 0 raw science data as described in the AQ GS Data Processing System Plan.
The ADPS shall process received Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.
The ADPS shall process received Service Platform telemetry including Observatory attitude data as described in the AQ GS Data Processing System Plan.
The ADPS shall process received ephemeris data as described in the AQ GS Data Processing System Plan.

- The Aquarius Ground System shall use UTC time for all ground operation command and data products.

Test Cases:

This test can be run in conjunction with the test ADPS Retrieval, Scheduling and Archiving Test, AGS-DPS-C-001, as a single test event.

Test Case 1

Process each downlink in sequence with Level-0-to-1A software and generate temporary Level-1A orbit files. Process temporary files with Level-1A merge software and generate a single set of Level-1A orbit files for the day.

Test Case 2

Same as Case 1, for seven consecutive days.

Pass/Fail Criteria:

Test Case 1

All Level-1A product files are successfully generated and fully populated with raw Aquarius science data and HKT data, raw SAC-D HKT data, ephemeris data, converted Aquarius HKT data, extracted SAC-D attitude data and product metadata as specified in the Aquarius Level-1A Product Format Specification; conversion of GPS time to UTC is verified; all products are archived and cataloged by the ADPS.

Test Case 2

Same as Case 1, for all 7 days (103 orbits) of data.

Pre-requisite Tests: ADPS Retrieval, Scheduling and Archiving Test, AGS-DPS-C-001

Test Location(s): Goddard

Test data: Simulated Aquarius HRD downlink files, Simulated Observatory HKT, SAC-D ephemeris files.

Test equipment: none

Personnel: One data system software engineer, one test reviewer

Duration: 1 day (Case 1), 7 days (Case 2)

viii. ADPS Level-2 Algorithm Test, AGS-DPS-C-003

Test Purpose: Verify that the L3 Requirements that apply to the ADPS Level 2 Algorithm are satisfied.

Applicable Level 3 Requirements:
The ADPS shall acquire and utilize ancillary data products to process Aquarius science data as defined in the AQ GS Data Processing System Plan.
The ADPS shall process Level 1 science files into Level 2 files as described in the AQ GS Data Processing System Plan.
- The ADPS shall deliver Level 2 files to the Aquarius science team and co-investigators as defined in the AQGS to Science Team Interface Control Document.

Test Cases:

Test Case 1

ADPS will acquire, ingest and preprocess required ancillary data files as specified in the L3 Science Algorithm Requirements, for all days of data to be processed; schedule and process Level-1A products generated by AGS-DPS-C-001 to generate Level-2 products (one-for-one); post Level-2 products on OBPG Browse and Order web site for downloading by Science Team members.

Test Case 2

Same as Case 1, for seven consecutive days.

Pass/Fail Criteria:

Test Case 1

All ancillary data files are successfully acquired and preprocessed; all Level-1A products are successfully processed to Level-2; all Level-2 products are fully populated with Radiometer, Scatterometer and geolocation fields, quality flags and product metadata; all Level-2 products are staged on the Browse and Order web site; sample products are downloaded; data fields are verified by members of the Science Algorithm Team.

Test Case 2

Same as Case 1, for all seven days (103 orbits).

Pre-requisite Tests: ADPS Level 0 to 1A Processing Test, AGS-DPS-C-002

Test Location(s): Goddard

Test data: Aquarius Level-1A Data Products, ancillary data files.

Test equipment: none

Personnel: One data system software engineer, science algorithm team members, one test reviewer.

Duration: 1 day (Case 1), 7 days (Case 2)

ix. ADPS Level-3 Algorithm Test, AGS-DPS-C-004

Test Purpose: Verify that the L3 Requirements that apply to the ADPS Level 3 Algorithm are satisfied.

Applicable Level-3 Requirements:

- The ADPS shall process Level 2 Aquarius science files into Level 3 products as described in the AQ GS Data Processing System Plan.
- The ADPS shall deliver Level 3 data files to the Aquarius science team and co-investigators as defined in the AQ GS to Science Team Interface Control Document.

Test Cases:

Test Case 1

ADPS will schedule and process Level-2 products by the Level-2-to-3 binning software to generate Level-3 Daily Binned products; ADPS will schedule and process Level-2 products by the Level-2-to-3 smoothing software to generate Level-3 Daily Smoothed products; ADPS will schedule and process Level-3 Daily products by the Level-3 binning software to generate Level-3 Weekly products; ADPS will schedule and process all Level-3 binned and smoothed products by the Level-3 Mapping software to generate Level-3 Daily and Weekly Mapped products; Level-3 Mapped products are posted on the OBPG Browse and Order web site for downloading by Science Team members.

Test Case 2

Same as Case 1 for four consecutive weeks.

Pass/Fail Criteria:

Test Case 1

All Level-3 products are successfully generated and populated with Sea Surface Salinity (SSS) fields and product metadata; all Level-3 Mapped products are posted on the OBPG Browse and Order web site; sample Level-3 products are downloaded; the Level-3 Smoothing is verified by the Science Algorithm Team.

Test Case 2

Same as Case 1 for four consecutive weeks.

Pre-requisite Tests: ADPS Level-2 Algorithm Test, AGS-DPS-C-003

Test Location(s): Goddard

Test data: Aquarius Level-2 data products

Test equipment: none

Personnel: One data system software engineer, science algorithm team member(s), one test reviewer

Duration: 7 days (Case 1); one month (Case 2)

9.2.2 Interface Tests

i) ACCS-ADPS Interface Test, AGS-I-001

Test Purpose: Verify that the Level 4 Requirements that apply to the ACCS-ADPS interface are satisfied.

Applicable Level 4 Requirements:

- The ACCS primary and backup computers shall interface with the ADPS to retrieve stored Aquarius and SACD HKT data.
- The ACCS shall interface with the ADPS via the OBPS standard network to obtain Level 1A data files.
- The Aquarius Analysis Tool shall interface with the Aquarius Data Processing System to retrieve stored Aquarius science and HKT data and SACD data.
- The Alarm and Error Notification Tool shall interface with the AQ Analysis tool in order to provide automated telemetry alarm detection.

Test Case 1

Requirements verified:

- The ACCS primary and backup computers shall interface with the ADPS to retrieve stored Aquarius and SACD HKT data.
- The Aquarius Analysis Tool shall interface with the Aquarius Data Processing System to retrieve stored Aquarius science and HKT data and SACD data.
- The Alarm and Error Notification Tool shall interface with the AQ Analysis tool in order to provide automated telemetry alarm detection.

Place at least one AQ/SAC-D HKT file onto the ADPS in the ACCS retrieval directory. Verify the AQ/SAC-D HKT file(s) can be retrieved from the ADPS and processed by the Telemetry Viewer and the Analysis Tool. Verify known alarm conditions within the data set are correctly displayed via the Alarm and Error Notification Tool.

Test Case 2

Requirements verified:

- The ACCS shall interface with the ADPS via the OBPS standard network to obtain Level 1A data files.
- The Aquarius Analysis Tool shall interface with the Aquarius Data Processing System to retrieve stored Aquarius science and HKT data and SACD data.
- The Alarm and Error Notification Tool shall interface with the AQ Analysis tool in order to provide automated telemetry alarm detection.

Place at least one AQ Level 1A file onto the ADPS in the ACCS retrieval directory. Verify the Level 1A file(s) can be retrieved from the ADPS and processed by the Analysis Tool. Verify known alarm conditions within the data set are correctly displayed via the Alarm and Error Notification Tool.

Pre-requisite Tests: Component tests for the ACCS Equipment, Telemetry Viewer, Analysis Tool and Alarm and Error Notification Tool.

Test Location(s): Goddard

Test data: at least one sample Level 1A file, and sample AQ/SAC-D HKT file.

Test equipment: none

Personnel: CogEs for the: ADPS, Alarm and Error Notification Tool, and Analysis Tool; one test conductor, one test reviewer.

Duration: 3 days.

ii) ADPS-PO.DAAC interface test, AGS-I-002

Test Purpose: Verify that the Level 3 Requirements that apply to the ADPS-PO.DAAC interface are satisfied.

Applicable Level 3 Requirements:

- The ADPS shall deliver data files and products to the JPL PO.DAAC as defined in the ADPS to PO.DAAC Interface Control Document.

Test Cases:

Test Case 1

ADPS will notify PO.DAAC of the availability of Level-1A, Level-2 and Level=3 data products. PO.DAAC will retrieve data products from the OBPG distribution site.

Test Case 2

Pass/Fail Criteria:

Test Case 1

All Aquarius data products on the OBPG distribution site are successfully retrieved by the PO.DAAC.

Test Case 2

Pre-requisite Tests: ADPS Level 0 to 1A Processing Test, AGS-DPS-C-002; ADPS Level 2 Algorithm Test, AGS-DPS-C-003; ADPS Level 3 Algorithm Test, AGS-DPS-C-004.

Test Location(s): Goddard

Test data: Simulated Aquarius science packets, Simulated Observatory HKT, ephemeris.

Test equipment: none

Personnel: One PO.DAAC data analyst, one test reviewer

Duration: 1 day

iii) ST TM delivery SDGS-GSD-I-0044-a and Science data delivery SDGS-GSD-I-0042-a Tests

Test Purpose: Verify that the Level 3 Requirements that apply to the CUSS-ADPS interface are satisfied.

Applicable AQ GS Level 3 Requirements:

- The ADPS shall receive Level 0 raw science data as described in the AQ GS Data Processing System Plan.
- The ADPS shall receive Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.
- The ADPS shall receive Service Platform telemetry including Observatory attitude data as be described in the AQ GS Data Processing System Plan.
- The ADPS shall receive Observatory ephemeris data as described in the AQ GS Data Processing System Plan.

The details of these two tests are provided in the CONAE document SD GS Integration Plan.

iv) AR Reception and Confirmation Integration Test SDGS-GSD-I-0024-a

Action Reports Request and Response Integration Test SDGS-GSD-I-0025-a and

Voice Communication Integration Test SDGS-GSD-I-0028-a

Test Purpose: Verify that the Level 3 Requirements that apply to the SOP-ACCS interface are satisfied.

Applicable AQ GS Level 3 Requirements:
L3-AQ-f-141 Requirement: The Aquarius Command and Control Segment shall exchange Action and Operations Reports with the CONAE MOC via the MOSREPORT link as described in the SAC-D Ground to Aquarius Ground System ICD.

L3-AQ-f-142 Requirement: The Aquarius Command and Control Segment shall utilize off-nominal communications methods including MOSPHONE as described in the SAC-D Ground to Aquarius Ground System ICD in the event of failure of the primary communications methods, MOSEMAIL and MOSREPORT.

L3-AQ-f-60 Requirement: The Aquarius Command and Control Segment shall provide SAC-D calibration maneuver requests to the SAC-D MOC via the MOSEMAIL link at least 21 days in advance of the maneuver in accordance with the Cold Sky calibration target(s) specified by the Aquarius Science Team.

L3-AQ-f-78 Requirement: The Aquarius Command and Control Segment shall generate Aquarius instrument commands plans on the SAC-D MOC Scheduler using Aquarius commands and scripts stored on the CONAE database as defined in the SAC-D Ground to Aquarius Ground System ICD.

L3-AQ-f-84 Requirement: The Aquarius Command and Control Segment shall plan Aquarius instrument operations by scheduling Aquarius download times, thermal set-points, and other operational variables as specified in the Aquarius Instrument Operations Handbook.

L3-AQ-f-96 Requirement: The Aquarius Ground System shall test, validate via the Aquarius test-bed, and upload instrument software patches via the CONAE MOC.

The details of these two tests are provided in the CONAE document SD GS Integration Plan.

9.3 Incompressible Test List

Refer to JPL Design File 79, Aquarius Incompressible Test List, for the list of AQ GS tests within this category.

9.4 Test as You Fly Exceptions

Refer to the project document, “Aquarius Test As You Fly Exceptions List”, AQ-273-0527.

10. Stress Tests

Stress testing is incorporated into each of the Aquarius Ground System tests as specific test cases where possible. In general, these take the form of the following:

ACCS Extra-Nominal Telemetry Processing (processing multiple files in succession)
Multiple Concurrent Anomalies
ADPS Reprocessing During Standard Processing Operations

11. Aquarius Command and Control System Training

The following documents, tools and processes will support the training and certification of Aquarius instrument operators.

11.1 Aquarius Science, Instrument and Ground System Overview

This presentation and text material serves to introduce the entire Aquarius program at a very high level. It discusses the science objectives, error sources, instrument design, data flow through CONAE and final processing at GSFC.

The next level of detail for each of these elements is presented in a series of science papers written by members of the Aquarius development team and the Aquarius Independent Review Board, Aquarius instrument documents such as CDR presentations and ICDs, the Instrument Operations Handbook, and the Aquarius Operations Handbook.

11.2 ACCS User's Guide

This guide will be developed in order to train Aquarius operators on the design and use of the ACCS. It will include a description of the tools that comprise the ACCS, resources required, trouble-shooting information, and procedures for standard operations of the ACCS. The ACCS User's Guides for the command tool (SInter) and the Telemetry Viewer will be provided by CONAE. All other documentation will be provided by the Aquarius instrument or ground system and operations team.

11.3 Aquarius Operations Handbook (Policies, Processes and Procedures)

This is to be a high-level document that describes the overall Aquarius Ground System and its interfaces, the Aquarius instrument, and procedures for all daily and contingency operations for both the instrument and the ground system. It includes process descriptions for configuration management, uplinking (planning), and downlinking (science and telemetry monitoring).

11.4 Mission Scenarios

Operators participating in System Level Uninterrupted data flows and Mission Scenarios will update normal and anomaly procedures in accordance with lessons learned during the exercise of draft procedures during mission scenarios. The process of optimizing procedures will serve as a valuable training process.

11.5 Aquarius Test-Bed

Operator training includes review of the Testbed Software Documentation and the Aquarius Test-bed User's Manual (AQ-385-0539) as well as exercising the complete Aquarius Test-bed Acceptance Test Procedure.

Standard and contingency procedures can be practiced against the Aquarius Test-Bed. Certain anomalies may also be simulated in order to train the operator to recognize various problems via direct telemetry observation and trending and also via analysis of science data.

11.6 Certification

Aquarius instrument operators undergoing training must pass a certification test prior to taking on full Aquarius command and monitoring responsibilities. A web-based certification program and test shall be implemented for Aquarius in conjunction with the training tools described above.

12. Appendix A – AQ GS Verification and Validation Matrix

L3 Requirement #	L3 Requirement	Verification Method	Test ID
L3-AQ-f-143	**Requirement:** The NASA Ground Network shall exercise NGN-SAC-D S-Band command and telemetry links by supporting at least one of the following SAC-D activities each month: proficiency test, orbit maneuver, cold sky calibration, other special operation.	Analysis	
L3-AQ-f-144	**Requirement:** The Aquarius Data Processing Segment shall update the calibration coefficients utilized in Aquarius data processing in accordance with science team directives.	Analysis	
L3-AQ-f-133	**Requirement:** The Aquarius ground system shall plan for the continuous operations of the Aquarius instrument throughout the entire mission life except during special circumstances such as orbit maneuvers, safe-hold or other unexpected situations.	Analysis	
L3-AQ-f-11	**Requirement:** The ADPS shall acquire and utilize ancillary data products to process Aquarius science data as defined in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-13	**Requirement:** The ADPS shall receive Level 0 raw science data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-14	**Requirement:** The ADPS shall receive Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-15	**Requirement:** The ADPS shall receive Service Platform telemetry including Observatory attitude data as be described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-16	**Requirement:** The ADPS shall receive Observatory ephemeris data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-17	**Requirement:** The ADPS shall log received Level 0 raw science data as described in the AQ GS Data Processing	Test	

	System Plan.		
L3-AQ-f-18	**Requirement:** The ADPS shall log received Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-19	**Requirement:** The ADPS shall log received Service Platform telemetry including Observatory attitude data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-20	**Requirement:** The ADPS shall log received ephemeris data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-151	**Requirement:** The ADPS shall manage received Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-21	**Requirement:** The ADPS shall process received Level 0 raw science data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-22	**Requirement:** The ADPS shall process received Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-23	**Requirement:** The ADPS shall process received Service Platform telemetry including Observatory attitude data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-24	**Requirement:** The ADPS shall process received ephemeris data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-25	**Requirement:** The ADPS shall archive received Level 0 raw science data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-26	**Requirement:** The ADPS shall archive received Aquarius HK telemetry data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-27	**Requirement:** The ADPS shall archive received Service Platform telemetry including Observatory attitude data as described in the AQ GS Data Processing System Plan.	Test	

L3-AQ-f-28	**Requirement:** The ADPS shall archive received ephemeris data as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-30	**Requirement:** The ADPS shall make AQ data and products available to the AQ Science Team and other PI approved users as it is created beginning at launch.	Test	
L3-AQ-f-31	**Requirement:** The ADPS shall process Level 1 science files into Level 2 files as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-32	**Requirement:** The ADPS shall process Level 2 Aquarius science files into Level 3 products as described in the AQ GS Data Processing System Plan.	Test	
L3-AQ-f-34	**Requirement:** The ADPS shall deliver Level 2 files to the Aquarius science team and co-investigators as defined in the AQGS to Science Team Interface Control Document.	Test	
L3-AQ-f-37	**Requirement:** The ADPS shall deliver Level 3 data files to the Aquarius science team and co-investigators as defined in the AQ GS to Science Team Interface Control Document.	Test	
L3-AQ-f-38	**Requirement:** The ADPS shall deliver data files and products to the JPL PO.DAAC as defined in the ADPS to PO.DAAC Interface Control Document.	Test	
L3-AQ-f-41	**Requirement:** The Aquarius Ground System Data Processing Plan shall include the release of the first Level 2 and 3 Aquarius data products not later than twelve months after launch.	Analysis	
L3-AQ-f-42	**Requirement:** After the first release of validated Aquarius data, the Aquarius Ground System shall deliver data products to the PO.DAAC no later than six months after measurements are taken in orbit.	Analysis	
L3-AQ-f-44	**Requirement:** The ADPS interface with Aquarius Validation Data System (AVDS) shall be defined in the AVDS to	Test	

	ADPS Interface Control Document.		
L3-AQ-f-45	**Requirement:** The AVDS processing shall be described in the AQ GS Data Processing System Plan and the Aquarius Validation Data System (AVDS) Development Plan.	Test	
L3-AQ-f-47	**Requirement:** The Aquarius Ground System shall use UTC time for all ground operation command and data products.	Inspection	
L3-AQ-f-49	**Requirement:** The ADPS shall utilize UTC time reference for Aquarius data products.	Inspection	
L3-AQ-f-53	**Requirement:** The ADPS shall retain ingested AQ Level 0 and above data and products for the life of the mission + 6 months.	Analysis	
L3-AQ-f-54	**Requirement:** The ADPS shall provide data production services on an ongoing basis for the life of the Aquarius mission including data reprocessing. This is baselined as 3 years + 6 months post-launch.	Analysis	
L3-AQ-f-114	**Requirement:** Early Orbit and Observatory Commissioning Phase ground coverage provided by NASA ground stations shall be defined in the NGN to Aquarius/SAC-D PSLA.	Inspection	
L3-AQ-f-116	**Requirement:** Science Operations Phase ground coverage provided by NASA ground stations shall be defined in the NGN to Aquarius/SAC-D PSLA.	Inspection	
L3-AQ-f-64	**Requirement:** The Aquarius Ground System shall support end-to-end testing between the Aquarius Ground System and the SAC-D MOC including functional and compatibility verification.	Inspection	
L3-AQ-f-65	**Requirement:** The Aquarius Ground System shall support end-to-end testing at the Western Range that verifies performance of Aquarius command generation, ground systems telemetry monitoring, and science processing.	Inspection	
L3-AQ-f-67	**Requirement:** The Aquarius Data Processing Segment shall support a 45 day check-out	Analysis, Test	

	period for the Observatory and ground systems prior to science operations by retrieving, processing, archiving, and distributing to the science team all Aquarius science and ancillary data available.		
L3-AQ-f-119	**Requirement:** The command, telemetry, and voice interfaces between CONAE and the NGN sites shall be defined in the NGN to Aquarius/SAC-D PSLA.	Inspection	
L3-AQ-f-93	**Requirement:** The ADPS processing rate shall be able to support reprocessing of the full Aquarius mission in six months or less.	Analysis	
L3-AQ-f-111	**Requirement:** The ADPS shall support the archive of the full Aquarius mission data set including science, ancillary, and housekeeping telemetry data.	Analysis	
L3-AQ-f-136	**Requirement:** The Aquarius Ground System shall be designed to be testable and verifiable consistent with mission test and verification plans.	Analysis	

Aquarius Command and Control Level 4 Requirements Test Matrix

L4-ACCS-1	**Information:** The components of the ACCS are: The Command Planning Tool, the Configuration Tracking Tool, the LUT Generation tool (deliverable), the Telemetry Viewer (deliverable tool but with telemetry scripts and pages configured internally), SInter (deliverable tool but with command scripts configured internally), the Test Bed (deliverable), the AQ Analysis Tool, the primary and backup computer systems, the interface with the ADPS, the interface with the CONAE Planning System, and the Alarm and Error Notification Tool.	**Verification**	**Test ID**
L4-ACCS-2	**Information:** Configurations are - three or fewer Radiometers on; primary or redundant Chirp Generator in use; for each ATC, primary or redundant sensor in use, for DPU, primary or backup EEPROM in use, for ICDS, primary or backup EEPROM in use, Scatterometer On/Off, Scatterometer on, transmitting or not. Modes are: normal, safe, off with heaters, off without heaters. Formats are: Operational LUT, ICDS s/w patches in use.		
L4-ACCS-3	**Requirement:** Sinter scripts shall be established for each mode, configuration, and format as adopted from instrument Integration and Test procedures.	Inspection	Memo/date/CM locat.
L4-ACCS-4	**Requirement:** Telemetry Viewer scripts shall be established for each mode, configuration, and format as adopted from instrument Integration and Test	Inspection	Memo/date/CM locat.

	procedures.		
L4-ACCS-5	**Requirement:** The AQ Configuration Tracking tool shall track Aquarius ICDS register states per the recommendation of section 3.2 of the Aquarius Flight Rules, Constraints and Idiosyncrasies document, AQ-385-0111.	Test	AGS-CCS-C-005
L4-ACCS-6	**Requirement:** The ACCS AQ Configuration Tracking Tool shall compare telemetered ICDS register states to the last commanded states.	Test	AGS-CCS-C-005
L4-ACCS-7	**Requirement:** The ACCS AQ Configuration Tracking Tool shall display inconsistencies between ICDS register states and the last commanded states.	Test	AGS-CCS-C-005
L4-ACCS-8	**Requirement:** The ACCS AQ Configuration Tracking Tool shall display the Aquarius mode, configuration, or format as defined in the Aquarius Instrument Requirements Document, AQ-325-0112.	Test	AGS-CCS-C-005
L4-ACCS-9	**Information:** Validation means to run a script against the Test-bed and verify the results are as expected. This also requires that the Test-bed behavior must be known with respect to the FM. These differences have been documented in the Aquarius Test Bed User's Guide, AQ-385-0539.		
L4-ACCS-10	**Requirement:** The Alarm and Error Notification Tool shall monitor for expected Level 0 files from CONAE according to the pass schedule.	Test	AGS-CCS-C-007
L4-ACCS-11	**Requirement:** The Alarm and Error Notification Tool shall provide notification of any file that has not been received within 10 minutes of expected.	Test	AGS-CCS-C-007
L4-ACCS-12	**Requirement:** The Alarm and	Test	AGS-CCS-C-007

	Error Notification Tool shall provide notification of any file containing a checksum error.		
L4-ACCS-13	**Requirement:** The Alarm and Error Notification Tool shall provide automatic notification of all file errors to the on-call staff member(s).	Test	AGS-CCS-C-007
L4-ACCS-14	**Requirement:** The Alarm and Error Notification Tool shall provide automatic notification of all detected alarms to the on-call staff member(s).	Test	AGS-CCS-C-007
L4-ACCS-15	**Requirement:** The Alarm and Error Notification Tool shall notify the Operations team of an alarm event within 5 minutes of processing that event.	Inspection	AGS-CCS-C-007
L4-ACCS-16	**Requirement:** The ACCS primary and backup computers shall include the CONAE payload interface tool, the "Scheduler Client", to support submitting commands to the SACD Spacecraft Operations Planning System.	Test	AGS-CCS-C-007
L4-ACCS-17	**Requirement:** The ACCS primary and backup computers shall include an Internet browser.	Test	AGS-CCS-C-001
L4-ACCS-18	**Requirement:** The ACCS equipment shall include standard telephone capable of international dial-up services.	Test	AGS-CCS-C-001
L4-ACCS-19	**Requirement:** The Command Planning Tool shall maintain a log of commands planned via the CONAE Spacecraft Operations Planning System.	Test	AGS-CCS-C-004
L4-ACCS-20	**Requirement:** Telemetry Viewer scripts shall include the conversion of GPS time from Aquarius telemetry to UTC time.	Test	AGS-CCS-C-002
L4-ACCS-21	**Requirement:** Telemetry Viewer pages shall include the	Test	AGS-CCS-C-002

	display of UTC time.		
L4-ACCS-22	**Requirement:** The Aquarius Analysis Tool shall display data and system time tags in UTC.	Test	AGS-CCS-C-006
L4-ACCS-23	**Requirement:** The ACCS Command Planning Tool shall utilize UTC time for all planning and reporting.	Test	AGS-CCS-C-004
L4-ACCS-24	**Requirement:** The ACCS primary and backup computers shall display UTC time.	Test	AGS-CCS-C-001
L4-ACCS-25	**Requirement:** The ACCS primary and backup computers shall be synchronized to Goddard System time to within 1 second.	Test	AGS-CCS-C-001
L4-ACCS-26	**Requirement:** SInter shall time-tag stored commands with UTC time.	Test	AGS-CCS-C-003
L4-ACCS-27	**Requirement:** The Aquarius Analysis Tool shall time-stamp reports in UTC.	Test	AGS-CCS-C-006
L4-ACCS-29	**Requirement:** The AQ Configuration Tracking Tool log shall time stamp events in UTC.	Test	AGS-CCS-C-005
L4-ACCS-30	**Requirement:** The CONAE Telemetry Viewer tool and associated scripts and pages shall be installed on the primary and backup computers.	Test	AGS-CCS-C-002
L4-ACCS-31	**Requirement:** The Command Planning Tool shall be sized to be equal to or greater than all software, files, and reports to be generated during the design life of the Aquarius instrument. (Note: all software, files and reports shall be stored on the ADPS system). That size is: 10 MB.	Test	AGS-CCS-C-004
L4-ACCS-32	**Requirement:** The Aquarius Analysis Tool shall be sized to be equal to or greater than all software, files, and reports to be generated during the design life of the Aquarius instrument. (Note: raw data and processed	Analysis	L. Hong Memo #, date

	files shall be stored on the ADPS system). That size is 100 GB.		
L4-ACCS-33	**Information:** L2B requirements stipulate that a download will occur at least once every 12 hours. Science file processing time is estimated to be 1 hour. Measured transfer time of science and HKT files from Cordoba to GSFC is less than 15 minutes. Analysis tool processing of the file is less than 10 minutes. Alarm notifications to the Operations team would occur immediately thereafter. Total elapsed time: 13.5 hours.		
L4-ACCS-34	**Requirement:** The AQ Analysis Tool shall automatically process all science and HKT files received from the ADPS.	Test	AGS-CCS-C-006
L4-ACCS-35	**Requirement:** The AQ Analysis Tool shall be capable of processing science and HKT files of maximum size within one hour of reception.	Test	AGS-CCS-C-006
L4-ACCS-36	**Requirement:** In the course of analyzing and recovering from an anomaly, the recovery command scripts will be run against the Aquarius Test-bed; the AQ Configuration Tracking tool shall ensure that SInter command scripts maintain Aquarius in a safe mode: Scatterometer transmitter off with switches to load; Radiometer switches to load.	Test	Mission Scenarios
L4-ACCS-37	**Requirement:** The ACCS Command Planning Tool shall schedule Cold Sky calibration maneuver requests.	Test	AGS-CCS-C-004
L4-ACCS-38	**Requirement:** The ACCS Command Planning Tool shall restrict Cold Sky Calibration request lead times to at least	Test	AGS-CCS-C-004

	21 days in advance of the maneuver.		
L4-ACCS-39	**Requirement:** The SInter command database shall consist of the full set of commands, with associated parameters, ranges (controlled via restriction), structures, and formats, as described in the Aquarius Command Dictionary.	Test	AGS-CCS-C-003
L4-ACCS-40	**Requirement:** The ACCS Command Planning tool shall maintain a database of all Aquarius command mnemonics and associated parameter types, order, and ranges.	Test	AGS-CCS-C-004
L4-ACCS-41	**Requirement:** The ACCS Command Planning tool shall enable a user to compile a command sequence (plan) from the command database.	Test	AGS-CCS-C-004
L4-ACCS-42	**Requirement:** The ACCS Command Planning Tool shall input the CONAE pass schedule in order to automate command planning time tag assignment.	Test	AGS-CCS-C-004
L4-ACCS-43	**Requirement:** The ACCS Command Planning Tool shall enable a user to assign time tags for commands relative to the start of a pass.	Test	AGS-CCS-C-004
L4-ACCS-44	**Requirement:** The ACCS Command Planning Tool shall enable a user to generate 14 days of command plans every 7 days.	Test	AGS-CCS-C-004
L4-ACCS-45	**Requirement:** The ACCS Sinter tool shall generate all Aquarius commands in the basic command format of one command per script.	Inspection	
L4-ACCS-46	**Requirement:** Each basic command generated by the SInter tool, over the full range of possible parameter inputs, shall generate a hexadecimal command output that is	Test	AGS-CCS-C-003

	identical to the command hexadecimal output of the command tool utilized in instrument integration and test activities at JPL.		
L4-ACCS-47	**Requirement:** The ACCS Command Planning Tool shall ensure that all command restrictions are implemented within each command plan in accordance with the Command Dictionary and the command restrictions document, AQ-385-0111 Aquarius Instrument Flight Rules, Constraints, & Idiosyncrasies.	Test	AGS-CCS-C-004
L4-ACCS-48	**Requirement:** The ACCS Telemetry Viewer Aquarius HKT hex to EU script conversions shall be identical to those implemented in the Aquarius I&T Test Conductor Telemetry Viewer scripts.	Test	AGS-CCS-C-003
L4-ACCS-49	**Requirement:** The SACD HKT hex to EU conversions implemented in the ACCS Telemetry Viewer shall be identical to those implemented in the CONAE MOC scripts.	Test	AGS-CCS-C-003
L4-ACCS-50	**Requirement:** The ACCS Telemetry Viewer shall be capable of ingesting S/P HKT.	Test	AGS-CCS-C-002
L4-ACCS-51	**Requirement:** The AQ Analysis Tool shall be capable of displaying and trending all Aquarius high rate data, all Aquarius HKT, and all SACD HKT.	Test	AGS-CCS-C-006
L4-ACCS-52	**Requirement:** The ACCS AQ Analysis Tool shall implement EU conversions for HKT according to the Aquarius telemetry dictionary.	Test	AGS-CCS-C-006
L4-ACCS-53	**Requirement:** The ACCS Telemetry Viewer shall be capable of displaying and trending all Aquarius HKT and	Test	AGS-CCS-C-002

	all SAC-D HKT.		
L4-ACCS-54	**Requirement:** The ACCS AQ Analysis Tool shall implement alarm settings for HKT according to the Aquarius telemetry dictionary.	Test	AGS-CCS-C-006
L4-ACCS-55	**Requirement:** The ACCS AQ Analysis Tool shall implement alarm settings for science data according to the Aquarius Instrument Operations Handbook.	Test	AGS-CCS-C-006
L4-ACCS-56	**Requirement:** The ACCS Telemetry Viewer scripts shall implement alarm settings for HKT according to the Aquarius telemetry dictionary.	Test	AGS-CCS-C-002
L4-ACCS-57	**Requirement:** The ACCS Telemetry Viewer scripts shall implement alarm settings for science data according to the Aquarius Instrument Operations Handbook.	Test	AGS-CCS-C-005
L4-ACCS-58	**Requirement:** The Analysis Tool shall log all alarm events from Aquarius or SACD data.	Test	AGS-CCS-C-006
L4-ACCS-59	**Requirement:** For each alarm event, the Analysis Tool shall display the time, the EU value of the telemetry point, and the alarm threshold crossed (red high/low, yellow high/low, green).	Test	AGS-CCS-C-006
L4-ACCS-60	**Requirement:** The ACCS AQ Configuration Tracking Tool shall log inconsistencies between ICDS register states and the last commanded states.	Test	AGS-CCS-C-005
L4-ACCS-61	**Requirement:** The ACCS AQ Configuration Tracking Tool shall log the Aquarius mode, configuration, or format as defined in the Aquarius Instrument Requirements Document, AQ-325-0112.	Test	AGS-CCS-C-005
L4-ACCS-62	**Requirement:** The ACCS shall interface with the ADPS via the	Test	AGS-I-001

	OBPS standard network to obtain Level 1A data files.		
L4-ACCS-63	**Requirement:** The ACCS shall interface with the ADPS via the OBPS standard network to obtain Goddard system time.	Test	AGS-I-001
L4-ACCS-64	**Requirement:** The ACCS primary and backup computers shall interface with the ADPS to retrieve stored Aquarius and SACD HKT data.	Test	AGS-I-001
L4-ACCS-65	**Requirement:** The ACCS Command Planning Tool shall enable a user to compile a command sequence (plan) from the command database.	Test	AGS-CCS-C-004
L4-ACCS-67	**Requirement:** The ACCS Command Planning Tool shall enable a user to assign time tags for commands relative to the start of a pass.	Test	AGS-CCS-C-004
L4-ACCS-68	**Requirement:** The ACCS Command Planning Tool shall input the CONAE pass schedule in order to automate command planning time tag assignment.	Test	AGS-CCS-C-004
L4-ACCS-70	**Requirement:** The Aquarius Analysis Tool shall provide the capability of generating science and HKT graphs interactively.	Test	AGS-CCS-C-006
L4-ACCS-71	**Requirement:** The Aquarius Analysis Tool shall provide the capability of generating science and HKT graphs at various levels of data resolution in order to support: daily, weekly, monthly, yearly, or mission length trends.	Test	AGS-CCS-C-006
L4-ACCS-72	**Requirement:** The Command Planning Tool shall be designed to be testable and verifiable consistent with mission test and verification plans.	Test	AGS-CCS-C-004
L4-ACCS-74	**Requirement:** The AQ Configuration Tracking Tool shall be designed to be testable and verifiable consistent with	Inspection	

	mission test and verification plans.		
L4-ACCS-75	**Requirement:** The Telemetry Viewer scripts shall be designed to be testable and verifiable consistent with mission test and verification plans.	Inspection	
L4-ACCS-76	**Requirement:** The Sinter scripts shall be designed to be testable and verifiable consistent with mission test and verification plans.	Inspection	
L4-ACCS-77	**Requirement:** AQ Analysis Tool shall be designed to be testable and verifiable consistent with mission test and verification plans.	Inspection	
L4-ACCS-78	**Requirement:** The primary and backup computer systems shall be designed to be testable and verifiable consistent with mission test and verification plans.	Inspection	
L4-ACCS-79	**Requirement:** The ACCS interface with the ADPS shall be designed to be testable and verifiable consistent with mission test and verification plans.	Inspection	
L4-ACCS-80	**Requirement:** The ACCS interface with the CONAE Planning System shall be designed to be testable and verifiable consistent with mission test and verification plans.	Inspection	
L4-ACCS-81	**Requirement:** The Alarm and Error Notification Tool shall be designed to be testable and verifiable consistent with mission test and verification plans.	Inspection	
L4-ACCS-83	**Requirement:** The Alarm and Error Notification Tool shall be designed to be testable and verifiable consistent with mission test and verification	Inspection	

	plans.		
L4-ACCS-84	**Requirement:** The ACCS Telemetry Viewer tool shall display Aquarius HKT software messages.	Test	AGS-CCS-C-002
L4-ACCS-85	**Requirement:** The ACCS Telemetry Viewer tool shall display Aquarius HKT bootlog messages.	Test	AGS-CCS-C-002
L4-ACCS-86	**Requirement:** The ACCS Telemetry Viewer tool shall display ICDS memory downloads.	Test	AGS-CCS-C-002
L4-ACCS-87	**Requirement:** The ACCS AQ Analysis Tool shall parse and display DPU memory downloads.	Test	AGS-CCS-C-006
L4-ACCS-88	**Requirement:** Any command script not validated during Aquarius/SAC-D ground testing must be validated against the Aquarius Test-bed prior to upload to the spacecraft during flight.	Inspection	

13. Appendix B – Problem Report Template

AQGS Ground Testing Problem Report

Test Name	_____
Test Step(s)	
Date/Time	
Reported By (Name)	
Description of Problem And Criticality Level	
Resolution or Mitigation	
Resultant Procedure Changes:	
Test	
Test Step(s) (Was/Is)	

14. Appendix C - Acronyms

ACCS	Aquarius Command and Control System
ADPS	Aquarius Data Processing System
AQ GS	Aquarius Ground System
ATLO	Assembly, Test, and Launch Operations
AVDS	Aquarius Validation Data System
CCB	Change Control Board
CONAE	Comision Nacional de Actividades Espaciales
GSFC	Goddard Space Flight Center
I&T	Integration and Test
ICD	Interface Control Document
JPL	Jet Propulsion Laboratory
MoU	Memorandum of Understanding
NGN	NASA Ground Network
PO.DAAC	Physical Oceanography Distributed Active Archive Center
SIS	Software Interface Specification
SAC-D	Satelite de Aplicaciones Cientificas D
TAYF	Test As You Fly
V&V	Verification & Validation